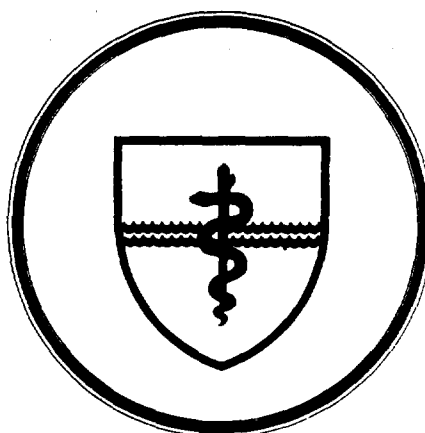
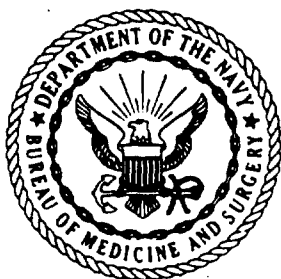


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# NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

SUBMARINE BASE, GROTON, CONN.



REPORT NUMBER 979

FILTER STABILITY, DIAGNOSTIC CONSISTENCY, and  
DURABILITY OF THE FARNSWORTH LANTERN COLOR VISION TEST

by

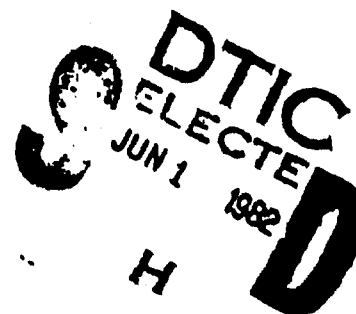
Helen M. Paulson

Naval Medical Research and Development Command  
Research Work Unit M0100-PN.001-1005

Released by:

William C. Milroy, CAPT, MC, USN  
Commanding Officer  
Naval Submarine Medical Research Laboratory

20 April 1982



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FILTER STABILITY, DIAGNOSTIC CONSISTENCY, AND  
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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND  
Research Work Unit M0100-PN.001-1005

Approved and Released by:

W. C. MILROY, CAPT MC USN  
Commanding Officer  
NAVSUBMEDRSCHLAB

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## SUMMARY PAGE

### PROBLEM

This Laboratory, as developer of the Farnsworth Lantern color vision test, has been the recipient through the years of various queries about the test. To provide answers to these queries, three investigations were undertaken.

### FINDINGS

The results of these investigations show the Farnsworth Lantern (FALANT) to be an outstanding instrument in terms of the stability of its filters, its diagnostic consistency, and its durability.

### APPLICATION

These findings provide answers to various queries about the FALANT and, in addition, necessary information for those military services and federal and civilian agencies expressing interest in using the FALANT in their color vision testing programs.

### ADMINISTRATIVE INFORMATION

This investigation was conducted as part of the Naval Medical Research and Development Command Work Unit M0100-PN.001-1005 Evaluation of current color vision standards for submariners and other Naval personnel. It was submitted for review on 29 March 1982, approved for publication on 20 April 1982 and designated as NSMRL Report No. 979.

PUBLISHED BY THE NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

# ABSTRACT

This Laboratory, as developer of the Farnsworth Lantern (FALANT), the U. S. Navy's color vision test, has been the recipient through the years of various queries about the test. To provide the answers, three investigations were undertaken. 1) The filters in several twenty-five-year-old FALANTS were measured and found to still meet the transmittance, chromaticity, and neutrality specifications. 2) Fifty-nine color defectives were tested on NSMRL's FALANT and on a Naval Air Station's FALANT which was thought to be too stringent and all examinees received the same Pass/Fail results. 3) A questionnaire evaluating the instrument's durability was sent to all the Armed Forces Entrance and Examining Stations and the responses indicated essentially trouble-free performance.



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## INTRODUCTION

There are many reports<sup>1-6</sup> on the performance, validity, and reliability of the Farnsworth Lantern (FALANT), which has been the U. S. Navy's test for color vision since 1954.<sup>7</sup> However, it appeared that investigations of the FALANT's filter stability, diagnostic consistency, and durability were needed to respond to various communiques this Laboratory, as developer of the FALANT, has received over the years. First, certain Naval activities have reported that individuals have received different Pass/Fail FALANT results at different testing facilities, with the suggestion that the colored filters in the lantern had changed with time. Second, specific inquiries were received from the Air Force and from the Federal Aeronautic Agency about the possibility of replacing their current color vision tests with the FALANT, but questioning its "high" cost. Finally, suggestions have been made that the FALANT be replaced with the Gunkel Chromagraph\* or with the Edridge-Green Lantern †

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\* The Gunkel Chromagraph is a new experimental test of color vision.<sup>8</sup>

† The Edridge-Green Lantern was the Navy's test of color vision prior to the adoption of the Farnsworth Lantern. Its limitations, documented in its evaluation in 1946,<sup>9</sup> led to the development of the Farnsworth Lantern.<sup>10</sup>

This paper reports the results of investigating three different features of the FALANT:

### Part I - Filter stability.

Measures were made to determine whether or not the percent transmittance, chromaticity, and neutrality of filters from three 25-year-old FALANTs still met specifications and were still comparable to filters in a recently-purchased one.

### Part II - Diagnostic Consistency.

A comparison was made of the performance of 59 color defectives on NSMRL's FALANT and on a specific Naval Air Station's FALANT. Complaints had been made that the latter instrument was more stringent than other FALANTs.

Part III - Durability. A questionnaire about the FALANT's durability was sent to administrators of the FALANT at all Armed Forces Entrance and Examining Stations.

## PART I - Filter Stability

The FALANT, pictured in Fig. 1, consists of red, green, and white lights, presented two at a time, in nine different color combinations; a dimming neutral filter is combined with one of the lights in each pair to reduce the transmittance of that light by 50%. The lights in the lantern are as follows, with the dimmed light being underlined:

#1	#2	#3	#4	#5	#6	#7	#8	#9
G	W	G	<u>G</u>	<u>R</u>	<u>W</u>	W	<u>R</u>	<u>R</u>
<u>R</u>	<u>G</u>	<u>W</u>	G	G	R	<u>W</u>	W	R

Each lantern, therefore, contains 27 filters - 6 reds, 6 greens, and 6 whites (neutrals), plus the 9

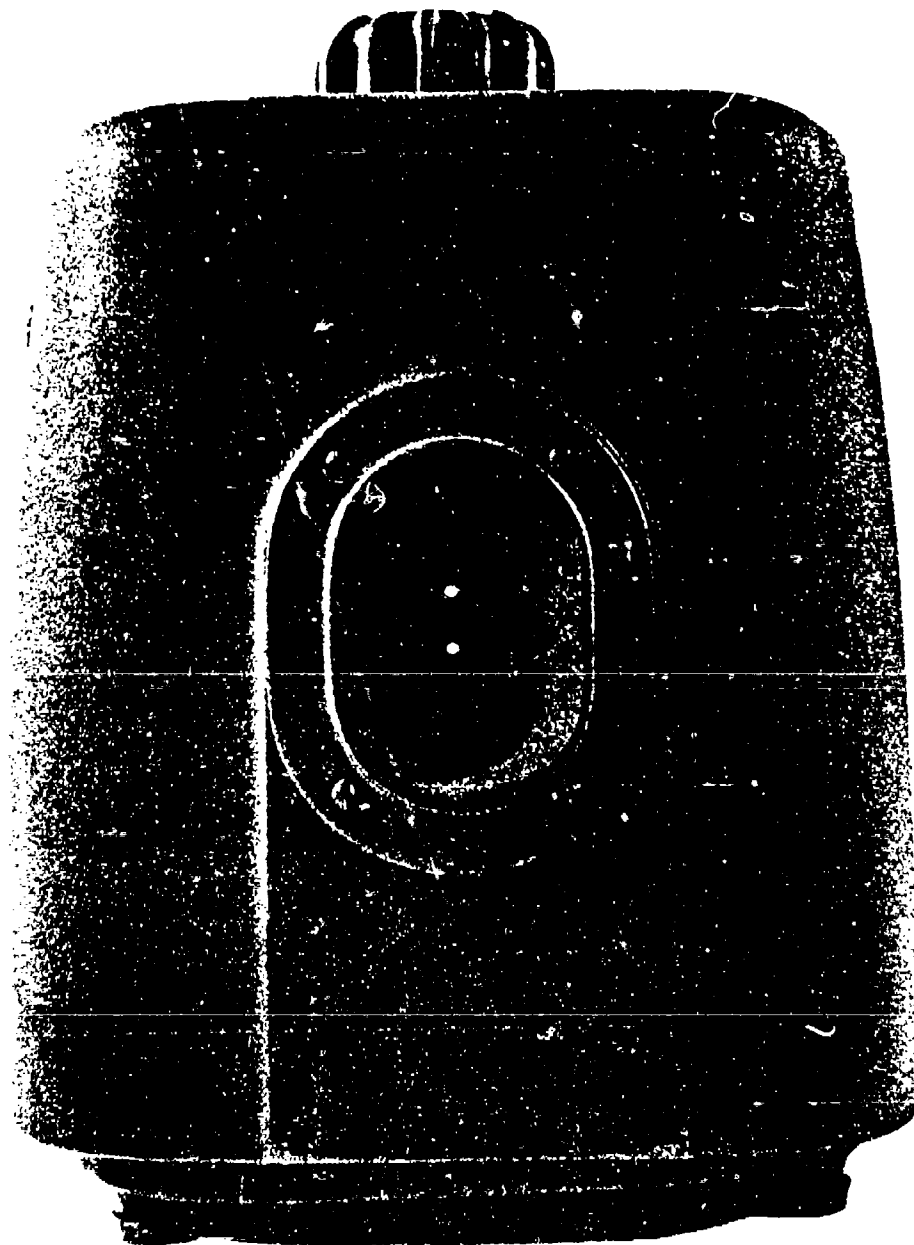


Figure 1. The Farnsworth Lantern

dimming (neutral) filters. From two randomly-selected 25-year-old FALANTs (denoted FALANTs A and B) and from a recently-purchased one (denoted FALANT C), all filters were removed and measured on the Macbeth Transmission Reflection Densitometer. These results are found in Table I. The procedure adopted was to select for measurement on the Cary Spectrophotometer one filter from each group with the highest density reading and one with the lowest density reading with the assumption that, if these selected filters met the transmittance and chromaticity specifications, the filters with densities falling between these "highs and lows" would also meet specifications. This procedure resulted in Cary spectrophotometric curves obtained on eight filters in FALANT A, six filters in FALANT B, and seven filters in FALANT C. A sample of these curves is found in Fig. 2.

Table II lists the specifications, as stated in Military Medical Purchase Description 6515-00-299-8587, for the percent transmittance and for neutrality (where appropriate) and the data on the filters as calculated from the spectrophotometric curves. In this table, there are data for filters from an additional lantern, denoted FALANT D; this lantern is the one from the Naval Air Station.

Figure 3 is the CIE (International Commission on Illumination) diagram depicting the chromaticity boundaries of the FALANT filters as stated in the military specifications. The chromaticity coordinates of these FALANT filters measured on the Cary spectrophotometer are given in Table III.

Referring to Tables II and III and Fig. 3, it is seen that FALANT A fully meets specifications. FALANT D meets the specifications with the exception that one red filter and one white filter are 0.1% too high in transmittance; this is considered to be insignificant in view of the fact that the filters are viewed through two etched aperture plate filters, one neutral and one clear, which together absorb over 80% of the light. FALANT C has one red filter with a transmittance reading 0.2% too high - again, insignificant; it also has one red filter plotting on the boundary line in Fig. 3 and one just outside the boundary line.

FALANT B contains red filters which are 0.6% too low in transmittance and plot outside the chromaticity boundary lines. The reason for these discrepancies is found in historical events during the development of the lantern. This lantern (Serial #127) was produced with filters from the first production run of FALANTs (which started with Serial # 126) and is a duplicate of the FALANT used at this Laboratory (Serial #132). There were many prototypes and pre-production models of the FALANT evaluated and rejected by this Laboratory during the period 1948-1954 in an attempt to find neutral and red filters which met the transmittance and chromaticity specifications stated in the military specification. By 1954, when the U. S. Navy Bureau of Medicine and Surgery announced the adoption of the Farnsworth Lantern as the official U. S. Navy color vision test,<sup>7</sup> a neutral filter had finally been found which met the specifications, but the red fell somewhat short on meeting the specifications. The inventor of the FALANT, CDR Dean Farnsworth,



Table I. Density measurements of FALANT filters

Filters	FALANT A		FALANT B		FALANT C	
	Density Measure-ments	No. of Filters	Density Measure-ments	No. of Filters	Density Measure-ments	No. of Filters
Reds	1.16 <sup>a</sup>	2	1.29 <sup>b</sup>	6	1.12 <sup>a</sup>	1
	1.18 <sup>a</sup>	4			1.14 <sup>a</sup>	3
					1.16 <sup>a</sup>	2
Greens	1.30	4	1.31	2	1.31	2
	1.31	2	1.32	2	1.32	1
			1.33	2	1.33	3
Whites (Neutrals)	1.21	2	1.27 <sup>b</sup>	6	1.28	2
	1.22	1			1.29	2
	1.23	2			1.30	1
	1.24	1			1.33	1
Dimming (Neutrals)	0.28	7	0.28	19	0.26	9
	0.29	2	0.29	2		

<sup>a</sup> With compensating purple filter

<sup>b</sup> With compensating neutral filter

Note: There were twelve more dimming filters in FALANT B than in FALANTS A and C because a dimmer went with each white filter and each red filter to reduce their transmittances to the required transmittance specification.

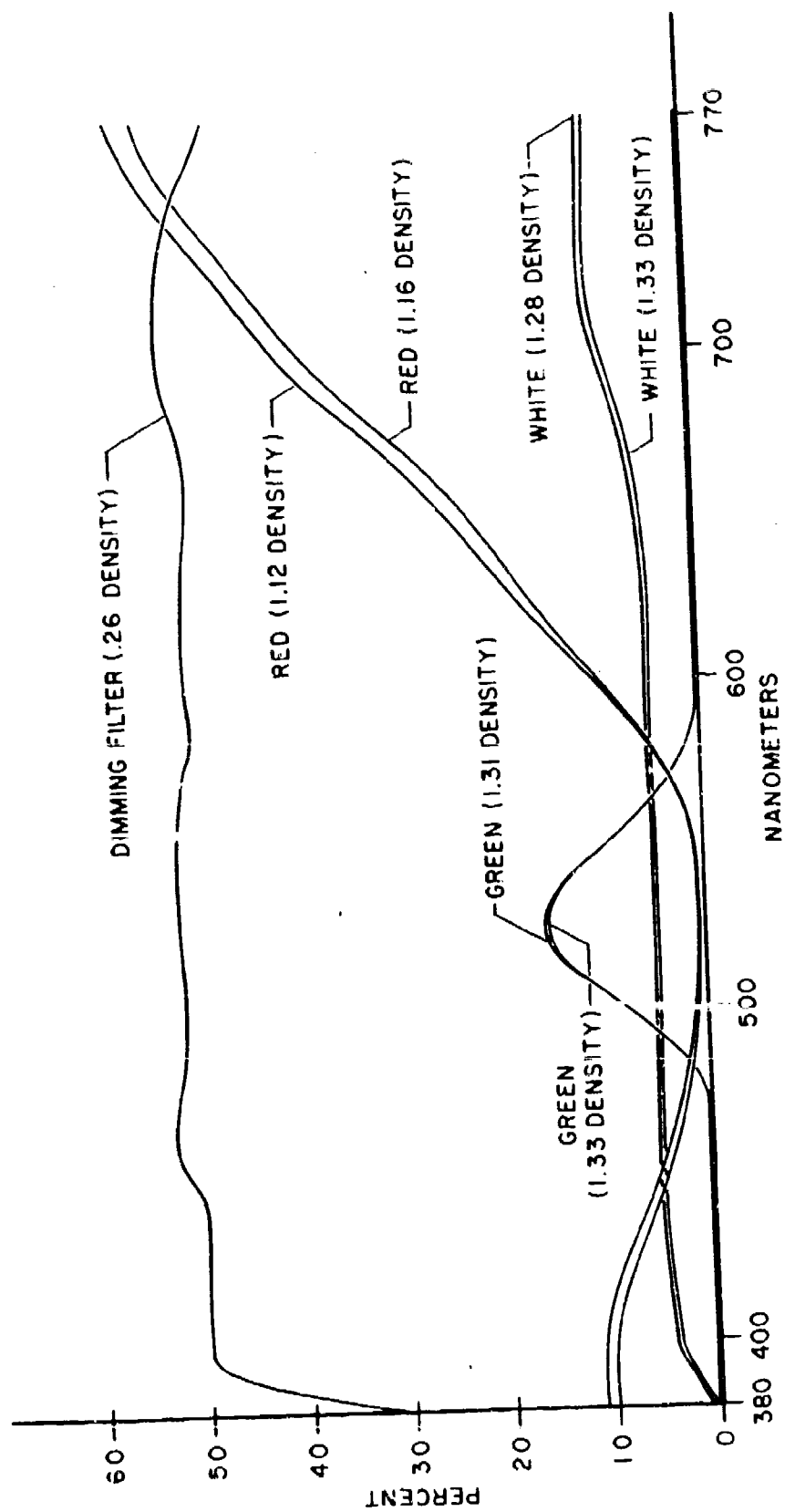


Figure 2. Cary spectrophotometric curves of filters in FALANT C

Table II. Military specifications and test results for percent transmittance (%T) and neutrality (Daylight Duplication Index (DDI))

Filter	Specifica- tion for %T	Specifica- tion for DDI	FALANT A		FALANT B		FALANT C		FALANT D	
			%T	DDI	%T	DDI	%T	DDI	%T	DDI
Red	5.5 - 6.5		6.4		4.9		6.7		6.6	
			6.0				6.3		6.4	
									6.1	
Green	4.5 - 5.5		4.8		5.0		5.0		5.1	
			4.7		4.8		4.9			
White (Neutral)	4.5 - 5.5	Less than 5	5.5	4.3	5.2	5.6	4.9	6.7	5.6	4.6
			4.7	3.3			4.5	7.2	4.9	5.3
Dimming (Neutral)	45.0 - 55.0	Less than 3	49.6	1.1	48.7	1.9	51.0	1.3	49.4	1.8
			49.4	1.1	48.6	2.6				

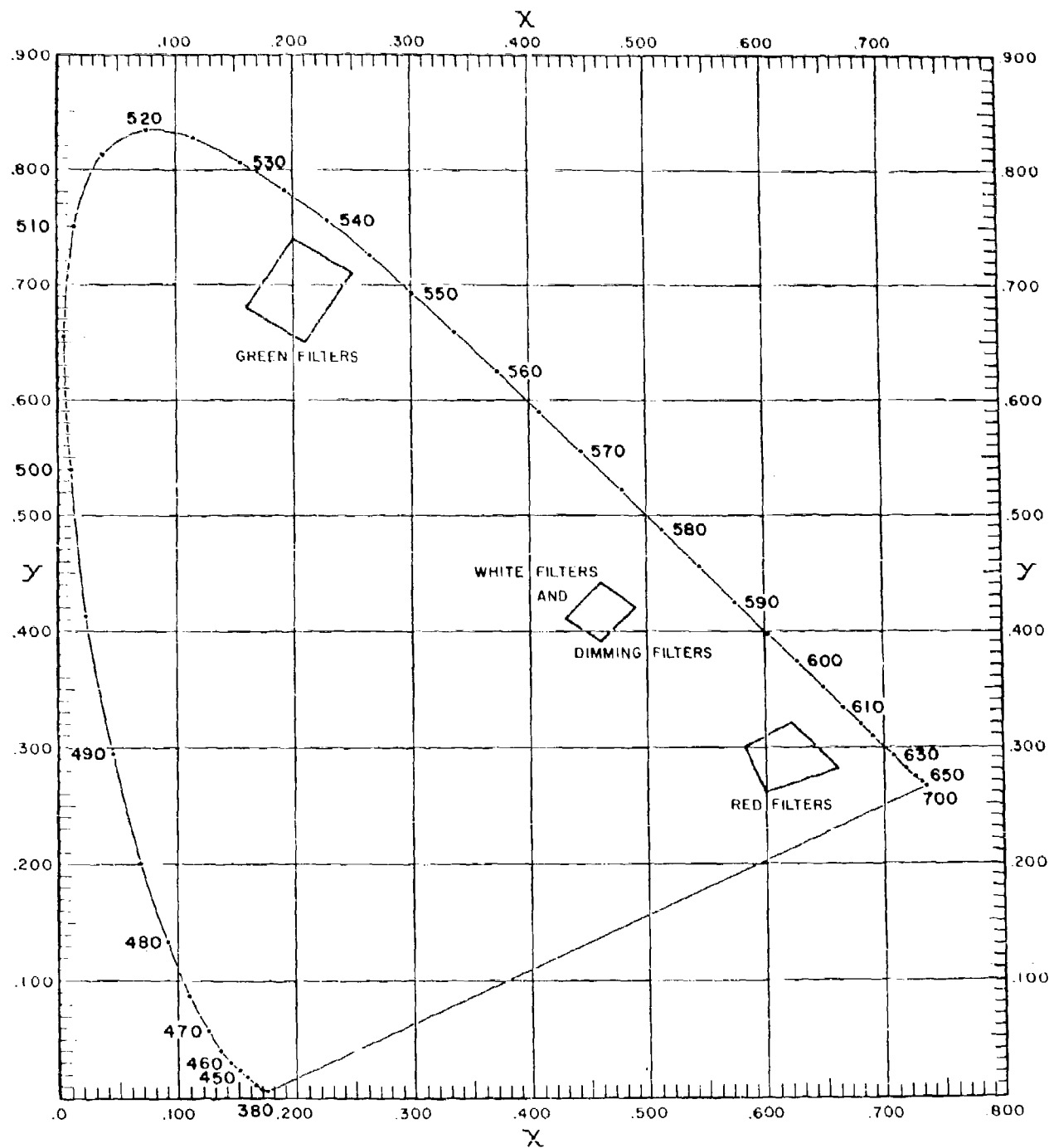


Figure 3. CIE diagram showing chromaticity boundaries for FALANT filters

Table III. Chromaticity coordinates of FALANT filters

FALANT	Red		Green		White		Dimming	
	x	y	x	y	x	y	x	y
A	.625	.313	.193	.705	.455	.422	.452	.411
	.632	.301	.202	.705	.458	.419	.451	.411
B	.674	.309	.199	.707	.464	.416	.453	.410
			.198	.709			.455	.410
C	.608	.315	.228	.693	.453	.402	.445	.409
	.612	.320	.227	.694	.450	.401		
D	.609	.307	.232	.694	.465	.417	.453	.410
	.611	.309			.463	.420		
	.613	.309						

decided to accept the best red filter available at that time and fifty FALANTs (Serial #s126-175) were so produced. Later on, a purple filter was used in combination with a red filter to bring the red filter within the chromaticity boundaries and to meet the transmittance specification. FALANT C (Serial #893), FALANT D, and all current models are of this type. Possible effects of these differences are investigated in Part II.

The results of Part I investigation show that the FALANT filters have not changed with age and should answer any query about filter fading. A final comment concerns the common complaint that the white light has yellowed with time. Of course, as has just been shown, the white light in FALANTs A, B, C, and D still meets specifications. The actual specifications, however, are for a yellowish-white, a color chosen by design to appear like a distant white light at sea through fog and haze. To make an examinee aware of this factor, the phrase "They look like signal lights at a distance" was added to the instructions and the examiner was directed to start the FALANT test with a red-green combination so that the examinee would see the red and green before being called upon to judge a white light.

#### Part II - Diagnostic Consistency

This investigation was prompted by a complaint from the Bureau of Naval Personnel that the Medical Department of a specific Naval Air Station was disqualifying more men for defective color vision than other Naval Air Stations and that one particular aviation candidate

has passed the FALANT at other activities but was disqualified by that NAS because he failed its FALANT.

The first action taken in response to the BUPERS complaint was to examine the candidate in question here at this Laboratory. He was administered the NSMRL battery of color vision tests (see Table IV) and was classified as a Moderate Deutan. He failed NSMRL's FALANT, as he had failed the NAS's FALANT. The fact that he had passed FALANTs at other activities is an example of problems uncovered in an evaluation of the FALANT's performance in the field.<sup>1</sup> In that evaluation, 55% of the color defectives who failed the FALANT at NSMRL had "Pass FALANT" records in their health jackets. Incorrect administration, improper entries in health jackets, and various other improper procedures were cited as reasons for this poor performance of the FALANT in the field. Corroborative evidence on faulty color vision testing in the field was also presented in this evaluation and the section is summed up by providing a detailed case history of the color vision testing of a typical case, a particular Navy man tested over a four-year period. Appendix A contains the NAS report on the color vision testing of this particular aviation candidate and is very similar to the case history in Reference 1.

The second action taken was to compare performance on the NAS FALANT with the FALANT here at NSMRL. During the time the NAS FALANT was here for examination, fifty-nine color defectives were administered the NSMRL battery of color vision tests (Table IV), classified as to type and degree of defect, and administered both lanterns. The Pass/Fail results were in total agreement - that is, every color defective who passed or failed one,

Table IV. NSMRL battery of color vision tests for classification of Protans and Deutans

Category	Plate Test	Anomaloscope	FALANT	Dichotomous-15 Test	H-16 Test
Normal Trichromats	PASS	Yellow to Yellow match	PASS	PASS	PASS
Mild Anomalous Trichromats	FAIL	Prots match a Red to Yellow; Deuts match a Green to Yellow	PASS	PASS	PASS
Moderate Anomalous Trichromats	FAIL	Prots match a Red to Yellow; Deuts match a Green to Yellow	FAIL	PASS	PASS
Severe Anomalous Trichromats	FAIL		FAIL	FAIL Protans have a Protan profile; Deutans have a Deutan profile	PASS
Dichromats	FAIL		FAIL	FAIL Prots have a Protan profile; Deuts have a Deutan profile	FAIL Prots have a Protan profile; Deuts have a Deutan profile.

Table V. Average error score obtained by fifty-nine color defectives on NSMRL's FALANT and a NAS FALANT

Degree of Defect	Protans			Deutans		
	N	NSMRL FALANT	NAS FALANT	N	NSMRL FALANT	NAS FALANT
Mild	0	-	-	15	0.20	0.23
Moderate	13	3.61	4.19	9	3.67	3.83
Severe & Dichromatic	10	5.25	6.05	12	5.12	6.21

passed or failed the other.

Table V presents the average error scores obtained by the various categories of color defectives. Even these average error scores, which would, of course, not be identical even if the same FALANT were administered to the same person twice, were in extremely close agreement, although generally slightly higher on the NAS FALANT. The only category of color defectives where the increase in error score is significant is the severe and dichromatic deutan category ( $p < .05$ ). However, it must be remembered that the exact average error is only critical when it is 1.0 or less (Pass FALANT) or 1.5 or more (Fail FALANT).

Even though unimportant in terms of Pass/Fail results, these slightly higher average error scores in the NAS FALANT vs the NSMRL FALANT warranted further investigation to determine the effect, if any, of the two different reds (the NAS FALANT had the reds which met the specifications and the NSMRL FALANT had the reds which were outside the specifications). Responses to the six reds, six greens, and six whites in each lantern were tabulated and the percentage of incorrect responses to these lights were as follows:

	<u>NSMRL FALANT</u>	<u>NAS FALANT</u>
Reds	4.05%	9.70%
Greens	23.16	24.29
Whites	39.27	45.01

Twice as many NAS reds were mis-called, but errors on red are a small proportion of the total errors. The reds have always been the easiest light for the color defectives to identify; in fact, four of the six reds in the test occur in the GR,

RG, and RR combinations and those three combinations are the easiest pairs of lights in the test.<sup>2</sup>

The NAS FALANT was returned with the report that its FALANT was of the same stringency as others in the field and that its medical personnel were to be commended for administering and scoring the test in accordance with instructions.

#### PART III - Durability of the FALANT

Through the years, this Laboratory has become aware of only two mechanical weak points in the FALANTs. One is the apparatus for moving and centering the pairs of lights. After years of violent spinning of the filter selector knob, the cam which centers the filters can become worn or cracked or the spring which moves the filter assembly around this cam can lose its tension. This is a serious weakness because the test lights may then be partially occluded and appear smaller or darker; the test results would then be invalid. The author informed the manufacturer of this cam problem and two remedial steps were taken: the cam is now made of stronger material and the scoring template directs examiners to refrain from spinning the knob violently when selecting lights at random. The relaxed spring problem is repairable - the spring has an adjustment screw.

The second weak point is that a few of the plastic disks which indicate to the examiner which pair of lights is being exposed may become loose and fall into the body of the instrument. This is not a serious weakness because they are three sets of these indicators to allow the examiner to administer the test from the rear, right, or left of the lantern.



If some disks are missing, the examiner can assume another testing position or retrieve the disks from the instrument and re-adhere them.

These two known weak points caused concern as to whether or not there might be other problems with the FALANTs in use at field activities. Hence a questionnaire was designed to elicit such information (Appendix B).

There are several hundred FALANTs in use - at the Armed Forces Entrance and Examining Stations (AFEES) and at many U. S. Naval activities, such as Regional Medical Centers, Air Stations, Submarine Bases, Nuclear Power Training Units, Recruit Training Commands, submarine tenders, carriers, destroyers, troop ships, and the U. S. Naval Academy. It was decided to send the questionnaire to the sixty-nine AFEES. All responded and since some activities had two FALANTs, reports were obtained on eighty lanterns. In an evaluation of the instrument's durability, it is important to note that some 200,000 persons are tested each year on these eighty FALANTs.

The results of the questionnaire show remarkably few mechanical problems with these eighty FALANTs. Responses to Questions #9-#16, which were designed to elicit such information, indicate substantially trouble-free performance. There were only two reports that the switch button had come off and the spring had popped out. This can be easily fixed by removing the filter-holder assembly and adjusting the screw at the base of that assembly. There was only one report that the centering device was not working and the knob had to be manually held in place for

full exposure of lights. This is the same problem discussed earlier in Part III and the corrective actions taken should avoid problems in the future.

There were 23 reports of no spare bulb. The bulb in the lantern had burned out (after approximately 1000 hours of use) and had been replaced by the spare bulb, but the spare bulb had not been replaced. The necessary ordering information is on the metal plate of instructions permanently affixed to the back of the lantern and a replacement bulb should have been ordered.

Question #16 was an open-ended one asking for information about any damage or deterioration to their lantern. The answers were extremely heartening. Only four of the eighty respondees reported any. Two explained that "colors seem to have faded," one explained that the "white is yellowing," and one explained that "the filters are discolored and the white looks yellow." This misinterpretation was discussed in Part I.

#### CONCLUSION

As other reports have shown the validity and reliability of the FALANT, these three investigations show it to be an outstanding instrument in terms of the stability of its filters, its diagnostic consistency, and its durability. Considering its "life" to be over twenty-five years, it is an excellent value dollar-wise. And its cost has not soared astronomically, as has happened with other equipment; in 1954 it cost \$450, and today, \$1800. The only requirement for valid color vision testing is that the examiner follow precisely the administration and scoring instruc-

tions printed on the metal plate permanently affixed to the lantern.

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APPENDIX A

March 1976

From: \_\_\_\_\_, LT MC USNR (FS), Branch Dispensary, Naval Air  
Station, \_\_\_\_\_,  
To: \_\_\_\_\_, CDR MC USN, Chief Bureau of Medicine and Surgery,  
Washington, DC  
Subj: \_\_\_\_\_, SSN

January 1973

\_\_\_\_\_, SSN, PLC (A) applicant was found not physically qualified at this Naval Air Station by reason of defective color, failed the Dvorine Pseudo-Isochromatic Plates and the Farnsworth Lantern test.

February 1973

O.S.O. \_\_\_\_\_, \_\_\_\_\_ then sent the applicant to another Naval Air Station, \_\_\_\_\_, \_\_\_\_\_ for another physical examination for the same program. (Keep sending until we find a medical department to pass them game!) At this time, he was found to be physically qualified and he passed the FALANT. I doubt if the test was actually given but that the applicant was asked if he ever had a physical examination and if he passed. The answer being yes to both questions. He was then asked if he passed the FALANT which was again answered yes and recorded as passed. Sometimes we assume that since he said he had normal color vision he must know since he has had a previous flight exam and since we know that color vision does not change. This individual has a very persuasive manner which probably influenced the examiner.

July 1973

He passed the FALANT at Marine Corps Air Station, \_\_\_\_\_, \_\_\_\_\_. Again I doubt that the test was ever given but recorded as passed from his last physical examination. In this case, it is common practice to record passed FALANT from the last physical examination since we all know that color vision does not change.

March 1974

He returned to this Naval Air Station and the examinee was again found not physically qualified due to defective color vision. Upon questioning him, we found him to be enrolled in PLC (A) program. We rechecked him three times that day with the last check Dr. \_\_\_\_\_ was present. On all the

tests he failed the FALANT. Since he was already in an aviation program, we typed his physical examination and submitted it to CMC DPD-4 for action. The applicant was found not physically qualified by CMC ltr MMRC \_\_\_\_ dtd Sep 1974.

#### November 1974

The applicant went to an FAA medical examiner with a 513 at the request of O.S.O., \_\_\_\_, \_\_\_\_. The FAA medical examiner found the applicant physically qualified and stated that the applicant passed the Dvorine Pseudo-Isochromatic Plates and the Farnsworth Lantern Test. I feel that this applicant could not pass the PIP if it was given correctly. Also, I wonder if this examiner has a Farnsworth Lantern test in his office since he is taking a fellowship in Cardiology at \_\_\_\_ Medical Center, \_\_\_\_, \_\_\_\_. Again the persuasive manner plays a part in the judgment of the examiner. The applicant is already a qualified commercial pilot second class. I do not know where he was given his third or second class medical examination or by whom. I do believe that the fact he had one influenced this examiner and possibly those before him.

#### December 1974

The results of the FAA examiner were forwarded to CMC and the applicant was again reinstated in the program.

#### January 1975

The applicant returned to this Naval Air Station and was again found disqualified by reason of defective color vision, unable to pass the PIP and FALANT tests.

#### March 1975

The applicant was given an appointment at a Naval Medical Center and passed by \_\_\_\_ Lt, MC, USN 9/9 FALANT. Later it was found that an HN gave the test incorrectly with the lights out and the applicant sitting directly in front of the lantern. The Hospital Corpsman also allowed four misses per run.

The applicant was sent to the Submarine Base to the Submarine Color Research Center and was finally found to be color defective by Ms. Helen Paulson, who assisted CDR Farnsworth in the development of the Farnsworth Lantern.

BUMED then sent the applicant to flight training for further color testing. This testing was not performed as I found out later in a telephone conversation with Ms. Paulson. This particular Naval Air Station felt that the Marine Corps Air Station was doing such a good job that there was no

need to recheck him. Consequently, Ms Paulson called the Naval Air Station and asked them to excuse the applicant from class and retest him. As you know, he failed and was eliminated from the flight program. All the color vision tests at this Naval Air Station were given by HMI \_\_\_\_\_.

In conclusion, I think it is fairly obvious that even the best testing procedures ultimately depend on the individual giving the exam. He must not only be technically proficient but perhaps more than that he must care enough about his job to be honest.

/s/

---

LT MC USNR (FS)

APPENDIX B

FARNSWORTH LANTERN (FALANT) QUESTIONNAIRE

1. Do you have a Farnsworth Lantern (FALANT)? Yes \_\_\_\_\_ No \_\_\_\_\_
2. What other color vision (perception) tests do you use? Please describe them adequately so that they can be identified.
3. Do you use the lamp designated in the Federal Supply Catalog as "Light, Color Perception Testing (6515 00 345 6625)" for plate test administration? Yes \_\_\_\_\_ No \_\_\_\_\_
4. If not, explain the illumination you use:

If you do not have a FALANT, the rest of this questionnaire does not apply to you. However, please indicate your rank/rate, activity, and address in the spaces at the end of this form and return.

If your activity has more than one color vision testing section, please duplicate the questionnaire and complete one for each section.

5. Do you give the FALANT to all Naval enlistees? Yes \_\_\_\_\_ No \_\_\_\_\_
6. Do you give the FALANT test to other personnel? Yes \_\_\_\_\_ No. \_\_\_\_\_  
If yes, explain:

7. The manufacturer's (Macbeth Corp.) Serial Number on your FALANT is \_\_\_\_\_

8. Approximately how many persons a month are tested on your lantern?  
\_\_\_\_\_

9. Is the switch button at the top of the lantern, which activates and deactivates the light bulb, still operative? Yes \_\_\_\_\_ No \_\_\_\_\_

10. Beneath and around the switch button referred to above, there is a knurled knob which, when turned clockwise or counterclockwise, brings the different pairs of colored lights in place behind the aperture plate for exposure to the examinee. Is the mechanism which this knurled knob controls still functioning properly so that the colored lights are fully exposed to the examinee when the switch button is depressed by the examiner? Yes \_\_\_\_\_ No \_\_\_\_\_
11. There are translucent indicator disks (color-coded and numbered) beneath the knurled knob which enable the examiner to know which pair of colored lights is being exposed for judgment by the examinee. The indicator disks allow the lantern test to be administered from the rear, right, or left of the lantern. Are these indicator disks still intact (i.e., they have not become loose and fallen out of place)? Yes \_\_\_\_\_ No \_\_\_\_\_
12. Is the knob at the bottom rear of the lantern, which raises and lowers the face of the lantern, still functioning? Yes \_\_\_\_\_ No \_\_\_\_\_
13. Is the set of instructions still affixed to the back of the lantern? Yes \_\_\_\_\_ No \_\_\_\_\_
14. Is there a spare bulb inside the base of the lantern? Yes \_\_\_\_\_ No \_\_\_\_\_
15. Has your lantern ever been repaired? Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_
16. Is there any other damage or deterioration to your lantern? Yes \_\_\_\_\_ No \_\_\_\_\_. If yes, please explain below:

RANK/RATE \_\_\_\_\_ ACTIVITY \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Please return this form to Military Enlistment Processing Command,  
Bldg. 83, Fort Sheridan, IL 60037 Attn: LCDR J. J. Dewhirst.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This Laboratory, as designer of the Farnsworth Lantern (FALANT), the U. S. Navy's color vision test, has been the recipient through the years of various queries about the test. To provide the answers, three investigations were undertaken. 1) The filters in several twenty-five-year-old FALANTs were measured and found to still meet the transmittance, chromaticity, and neutral- ity specifications. 2) Fifty-nine color defectives were tested on NSMRL's FALANT and on a Naval Air Station's FALANT which was thought to be too		

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stringent and all examinees received the same Pass/Fail results. 3) a questionnaire evaluating the instrument's durability was sent to all the Armed Forces Entrance and Examining Stations and the responses indicated essentially trouble-free performance.

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